MITS KITS ASSEMBLY HINTS

Dear Kit Customer,

Your MITS KIT comes to you supplied with highest quality electronic components and complete, easy-to-follow instruction manuals.

Before you begin to work on your kit, take the time to read through the assembly hints in this booklet. Whether you are a novice kit builder or an "old pro," you will want to note the information and the precautions regarding soldering, component ID and orientation, and tools.

By carefully following all assembly instructions and assembly hints, you can expect fast, trouble-free construction of your kit.

MITS

"Creative Electronics"

6328 Linn NE

Albuquerque, New Mexico 87108

ASSEMBLY MANUAL

All MITS assembly manuals offer understandable, step-by-step instructions to facilitate fast, systematic construction of your kit. It is important that you take your time reading the manual and following the instructions in the order they are presented. Taking what you think is a shortcut may prove to be a mistake later in the process.

A sample procedure from a MITS assembly manual is shown below. As you assemble your kit, read each instruction ① and refer to any accompanying illustrations ②. Note carefully any WARNINGS or NOTES ③ before beginning the assembly procedure. After you have performed a work step, check it off in the space provided ④.

. . . . . .

( ) Insert the capacitor into the correct holes from the silk-screened side of the board. Push the capacitor down until the ceramic insulation almost touches the foil pattern. ①

( ) Holding the capacitor in place, turn the board over and bend the two leads slightly outward.

④ ( ) Solder the two leads to the foil pattern on the back side of the board; then clip off any excess lead lengths.

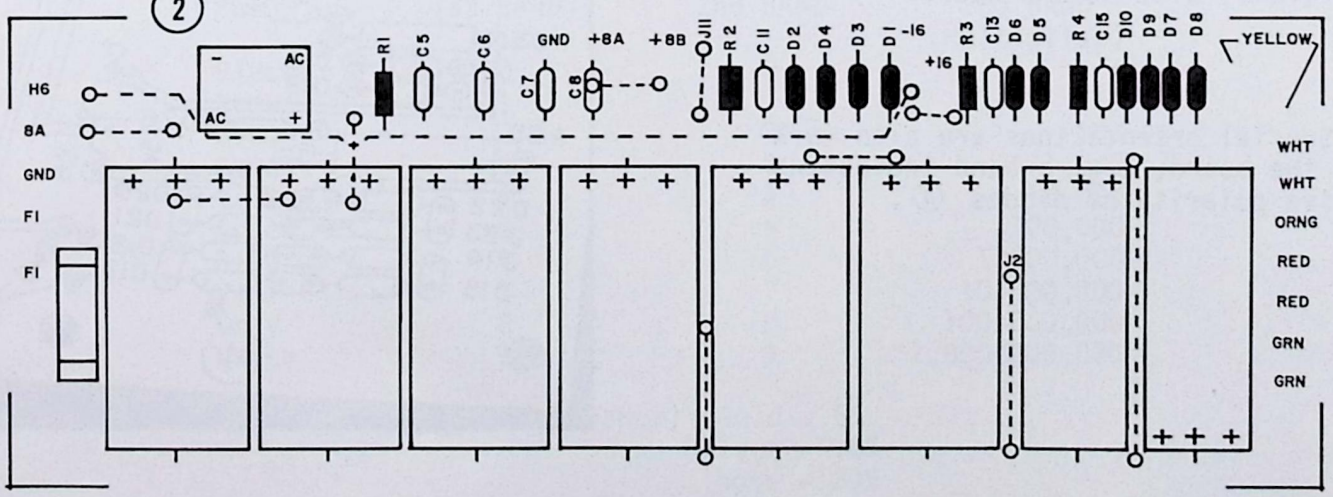
Install all of the ceramic disk capacitors in this manner. Be sure you have the correct value capacitor as you install each one.

All ceramic disk capacitors are .luf.

( ) C5 ( ) C6 ( ) C7 ( ) C8

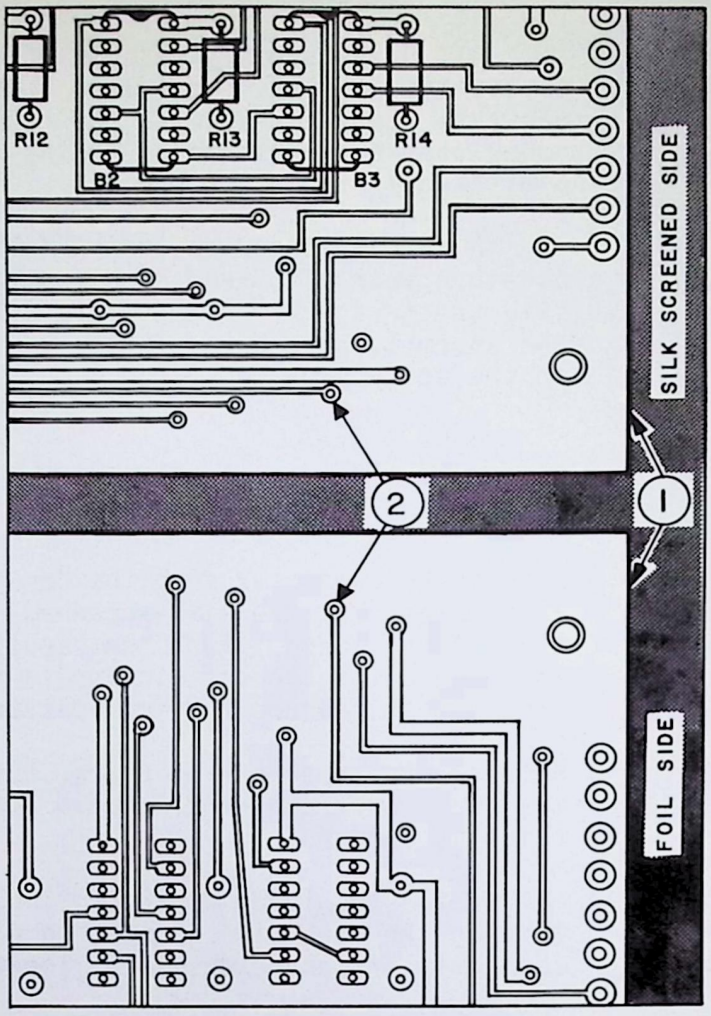
( ) C11 ( ) C13 ( ) C15

③ NOTE: Capacitors C13 and C15 must be rated at 50V. The voltage rating on the other capacitors may vary with the stock supply.

② 

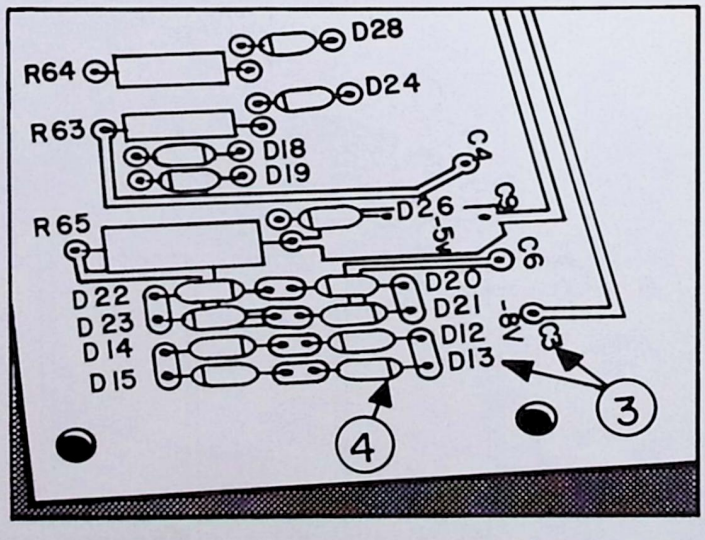
PRINTED CIRCUIT BOARDS

At the core of each MITS kit is at least one pre-drilled, fiberglass circuit board. Figure ① illustrates both sides of the same PC board. The boards have printed circuit lands on both sides which are connected by plated-through holes ②. Because the holes are plated through, it is only necessary to solder on one side of the board.



Each circuit board is silk-screened on one side with component designations and locations clearly marked ③. Generally the components are inserted on this side and soldered to the board on the other (foil) side of the board.

Special orientations are also marked on the board, e.g. a band indicating negative polarity of diodes ④.

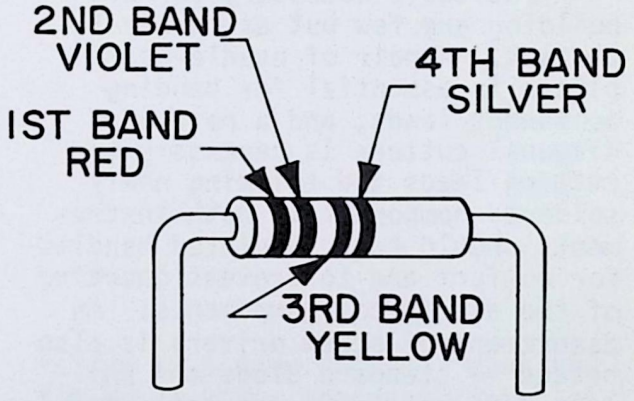


ELECTRONIC COMPONENTS

Various electronic components -- resistors, transistors, diodes, capacitors, integrated circuits and sockets -- are soldered to the circuit board. Most of these components have numbers or values which simplify their identification. When necessary, these identifying marks are called out specifically in the assembly manual.

Resistors have four (or possibly five) color-coded bands as represented in the chart below. The fourth band is gold or silver and indicates the tolerance. NOTE: In assembling a MITS kit, you need only be concerned with the three bands of color to the one side of the gold or silver (tolerance) band. These three bands denote the resistor's value in ohms. The first two bands correspond to the first two digits of the resistor's value and the third band represents a multiplier.

For example: a resistor with red, violet, yellow and silver bands has a value of 270,000 ohms and a tolerance of 10%. By looking at the chart below, you see that red is 2 and violet 7. By multiplying 27 by the yellow multiplier band (10,000), you find you have a 270,000 ohm (270K) resistor. The silver band denotes the 10% tolerance. Use this process to chose the correct resistor called for in the manual.



COLOR	1st BAND	2nd BAND	3rd BAND (Multiplier)
Black	0	0	1
Brown	1	1	10
Red	2	2	100
Orange	3	3	1,000
Yellow	4	4	10,000
Green	5	5	100,000
Blue	6	6	1,000,000
Violet	7	7	10,000,000
Gray	8	8	100,000,000
White	9	9	1,000,000,000

4th BAND (Tolerance): Gold - 5%
Silver - 10%
none - 20%

Always be sure you have selected the component specified in the manual. Capacitors come in various types and differ in shape and value. Transistors may be identical in appearance but differ in electrical characteristics, as determined by part number. IC's come with different markings necessary for proper orientation on the printed circuit board. The appendix at the back of this booklet can be used as a guide for identifying various electronic components and miscellaneous parts.

* * * * * * *

TOOLS

The tools necessary for kit building are few but extremely important. A pair of needle-nosed pliers is essential for bending component leads, and a pair of diagonal cutters is necessary for cutting leads and trimming newly soldered components. Both instruments should have insulated handles for comfort and to prevent shorting of the electrical components. An assortment of screw drivers is also needed -- standard blade and phillips 1/8" and 3/16" are most useful. Other tools that are helpful include blunt-nosed pliers, a ruler, a set of nut drivers and wire strippers (the inexpensive variety).

The right soldering iron is a key to successful kit building. You must use a 25-30 watt iron for all printed circuit assemblies. The soldering tip should be chisel-shaped. The delicacy and size of printed circuit boards precludes using a blunt-tipped iron. MITS recommends an Ungar 776 body with a 533 heating element. The 7155 chisel-shaped tip is ideal for printed circuit work. These can be purchased at most electronic parts stores.

WARNING!

WHEN SOLDERING COMPONENTS TO A PRINTED CIRCUIT BOARD DO NOT USE A SOLDERING GUN OR ANY HIGH WATTAGE IRON. THESE WILL DAMAGE THE BOARD AND THE COMPONENTS, AND THEIR USE WILL VOID YOUR KIT WARRANTY.

It is important to use the right kind of solder. We recommend Weller, Ersin or Kester rosin-cored solder with a .025-.030 inch diameter. Any electronic parts store should carry these or comparable brands if you find that the solder length supplied with the kit is not enough.

WARNING!

ABSOLUTELY DO NOT USE ACID CORE SOLDER!

SINCE ACID CORE SOLDER INVARIABLY CAUSES PERMANENT DAMAGE TO PRINTED CIRCUIT BOARDS AND ELECTRONIC COMPONENTS, ITS USE AUTOMATICALLY VOIDS THE MITS KIT WARRANTY.

* * * * * * *

TINNING

Some new soldering irons that have not been pre-tinned must be properly tinned before they can be used. Tinning is the application of a thin layer of solder to the iron's tip to discourage oxidation and to facilitate good heat transfer from the iron to the solder connection.

Tin the new tip as follows: plug in the iron's cord and wait for the tip to become hot enough to melt solder (approximately 60 to 90 seconds). Then apply a generous amount of solder to the tip. Wait a few minutes and then repeat the procedure. Wipe off any excess solder on a damp sponge. When the tip has a shiny appearance, it is ready for soldering.

To insure continued good soldering and an extended life for the soldering iron, you must keep the iron well tinned by applying a coat of solder when it is heated, but not in use. While using the iron you need to remove excess solder and any foreign material by wiping the tip of the iron on a damp sponge. Keep the heated tip away from wood, plastic or other materials which can leave deposits and ruin the tinning.

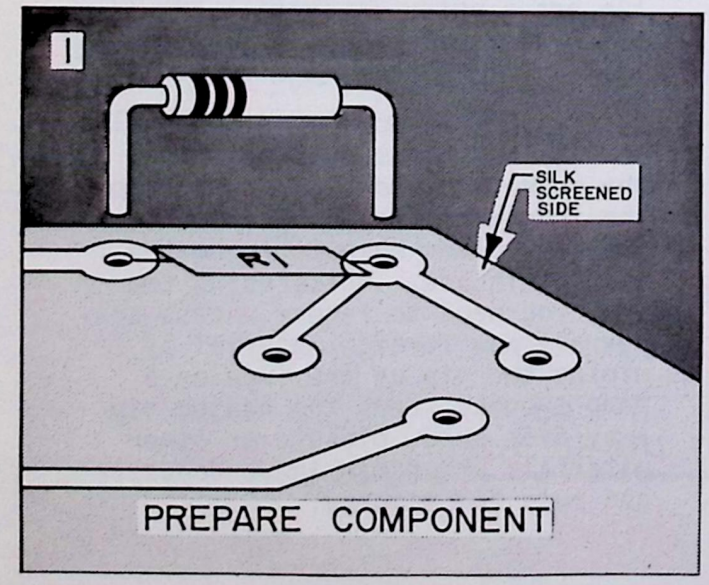
POSITIONING AND SOLDERING COMPONENTS

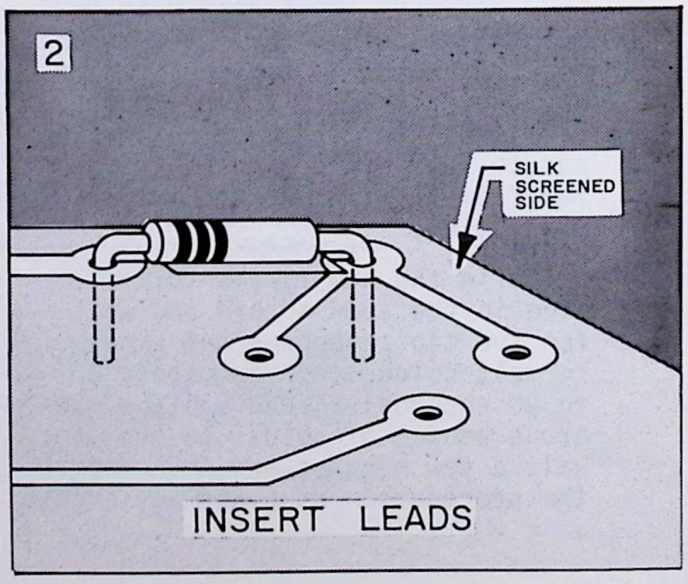
The purpose of soldering is to join two or more electrically conducting wires or components with a hard metallic bond which provides both mechanical strength and a low-resistance electrical path. This is the most significant aspect of kit building since the majority of problems in the completed unit can be traced to improper soldering. If you are a beginner or have had little soldering experience, you should read these instructions carefully.

Most of the soldering required for the assembly of MITS kits involves attaching electronic components to printed circuit boards. The board has specially laid out plated-copper wiring patterns called lands which join various components and/or wires. There are holes at various locations on the lands where the components are inserted. If the circuit boards have lands on both sides (and most MITS boards do), the holes are plated through, so it is only necessary to solder on one side of the board.

If you will follow a few simple procedures, soldering should not be a problem. The basic steps are summarized in the following text and accompanying diagrams.

First, prepare the component for insertion onto the board ①. The leads of resistors, diodes and capacitors must be bent at right angles so the proper fit can be achieved. It's a good idea to check the positioning of the component on the board (as described in the assembly manual) ahead of time so you can bend the leads at the right place. Then insert the component leads into the appropriate holes on the board so that the component rests flat against the board ②.

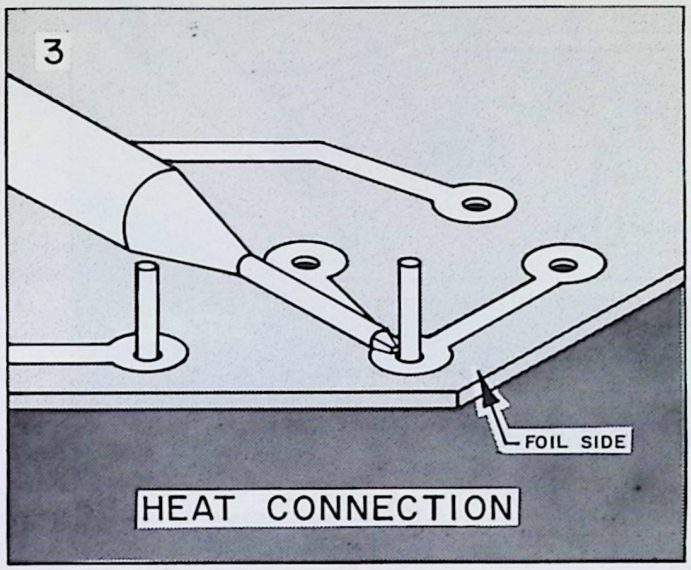


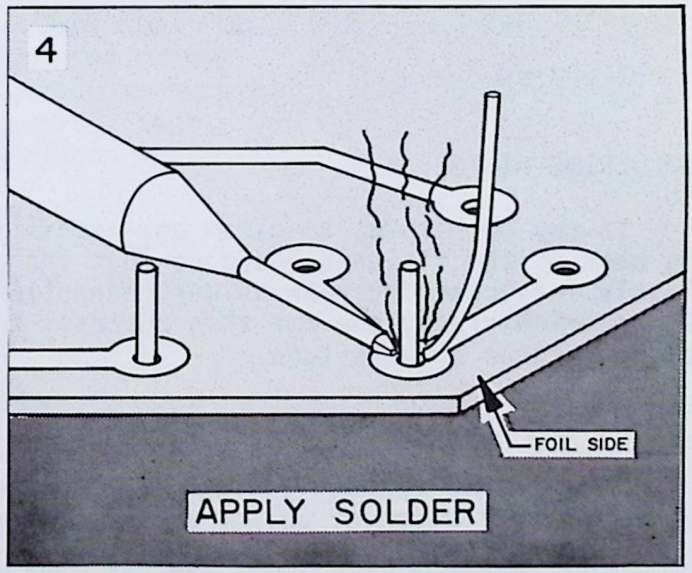


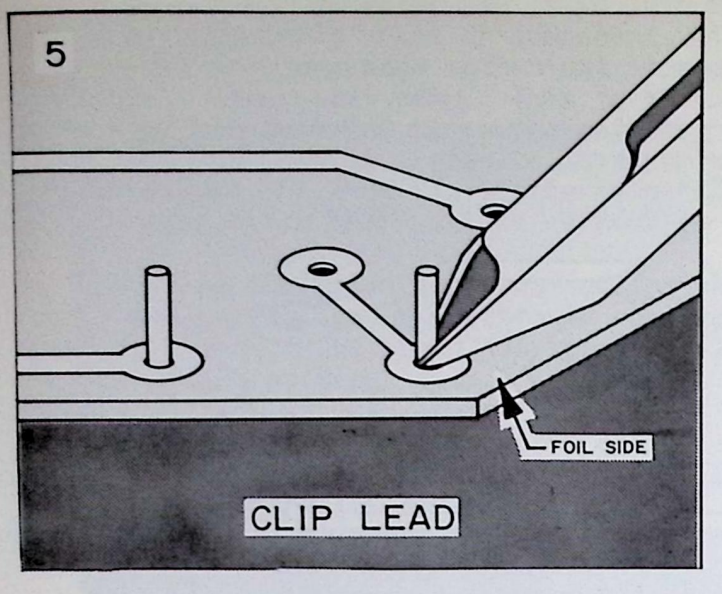
In most cases the component is on the silk-screened side of the board and soldering is done on the opposite, foil side. Any exceptions to this rule will be noted plainly in the assembly manual. Except in cases where the fit is critical, each component is soldered as it is inserted in the board. The assembly manual will spell out specific instances where several components are installed before they are soldered.

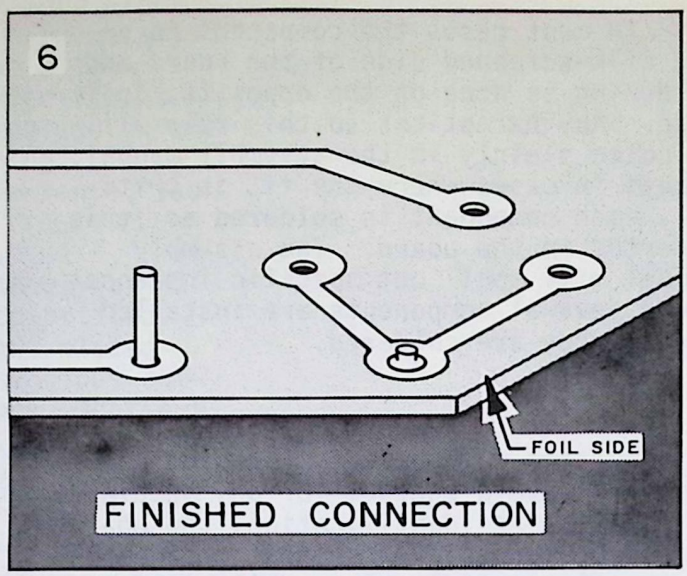
After the component is inserted and has been double-checked for any special orientation or identification, the board should be turned over so that the component will remain in place while it is being soldered. Then check that the area to be soldered is clean; any foreign substances will keep the solder connection from being a good one. Next, touch the heated tip of the soldering iron to the component lead and the adjoining plated-copper land ③. After several seconds touch the length of solder to the heated lead and allow a small amount of solder to flow over and around the lead so that a smooth bond is formed ④. Only a second or two is needed for the correct amount of solder to flow. (As noted in your assembly manual, special care must be taken when soldering heat-sensitive components, such as LEDs.)

It is important not to get too much solder but at the same time you should check to see that the plated-through hole is filled and the solder has flowed through to the other side of the circuit board. If the solder connection is not a good one (see "Soldering Hints"), remelt the old solder and wipe it off; then use fresh solder to mount the component.









When you have a good connection and the solder is cool, use the wire cutters to clip the lead off as close to the connection as possible ⑤ & ⑥.

* * * * * * *

SOLDERING HINTS

#1 CLEANING THE BOARD

It may be helpful to clean any excess rosin from the back of the finished board so that the board may be closely inspected for poor solder connections. We recommend trichlorethylene for this purpose, but alcohol may be used as a substitute.

#2 COLD SOLDER JOINTS

Good solder connections are shiny and smooth with an even distribution of solder around the component lead. If the solder doesn't flow properly or if the component or board are moved while the solder is cooling, a "cold solder joint" may result. A cold solder joint is dull, crystalline or coarse in appearance. It may have tiny pits or holes or have a bubble-like appearance. If you find a cold solder joint on the finished board, reheat it for a second or two so that the solder flows and a new connection is formed. (Touch on a little more solder if necessary.)

Also, be careful not to use so much solder that a "bridge" is formed across adjacent lands. If such a bridge should occur, remove it by applying heat on one of the lands it is across and wiping the molten solder away with a small stiff brush or a dry cloth. A good brush can be made by trimming the bristles on a small paint brush to about a quarter of an inch.

#3 BRIDGES

WARNING!

DO NOT HEAT ANY PORTION OF THE CIRCUIT BOARD
FOR MORE THAT A FEW SECONDS.
YOU WILL RISK HAVING THE LANDS
SEPARATE FROM THE BOARD.

Sometimes it may be necessary to remove a component that is soldered incorrectly to the board. This "un-soldering" procedure applies stress to the plated-copper lands and should be done quite carefully. You must heat the soldered connections one at a time and gently rock the component back and forth while pulling upward until the lead pulls free from the board.

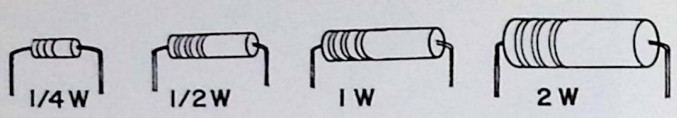
#4 UN-SOLDERING

After the component is pulled out, the molten solder will quickly fill up the hole. It will have to be removed so that the proper component can be inserted. To accomplish this, heat the solder and gently insert a wooden toothpick into the hole (while the solder is flowing). Do not twist or pry with the toothpick; simply remove it when the solder is cooled and the obstruction will be removed too. Commercial tools and other products (Soder-Wick) are also available for this purpose. If the plated through hole comes out with the solder, you must make sure that the new component inserted into that hole is soldered on both sides of the board so that all the necessary electrical connections are made.

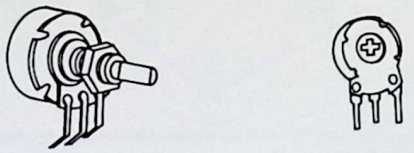
Since it obviously is somewhat difficult to "unsolder" components, it pays to double-check the components for proper orientation and identification before soldering them to the board.

TYPICAL COMPONENTS

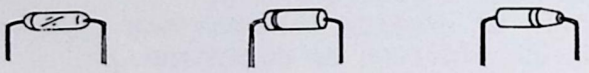
The following is a guide to commonly used electronic components and their schematic symbols. It should be used for general identification purposes only. Not all of the parts here will necessarily be in your kit.



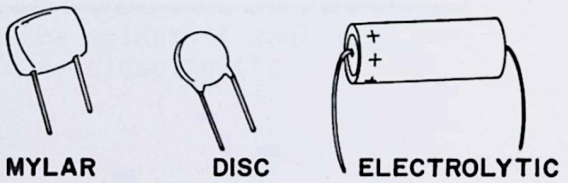
RESISTOR



POTENTIOMETER
(VARIABLE RESISTOR)

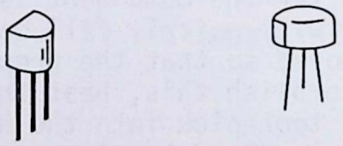


DIODES
(STANDARD) (ZENER)

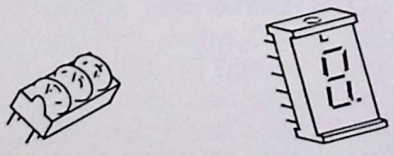


CAPACITORS

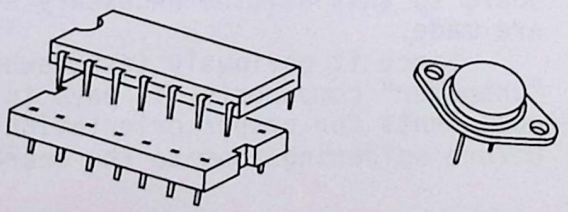
LIGHT EMITTING DIODES



TRANSISTORS

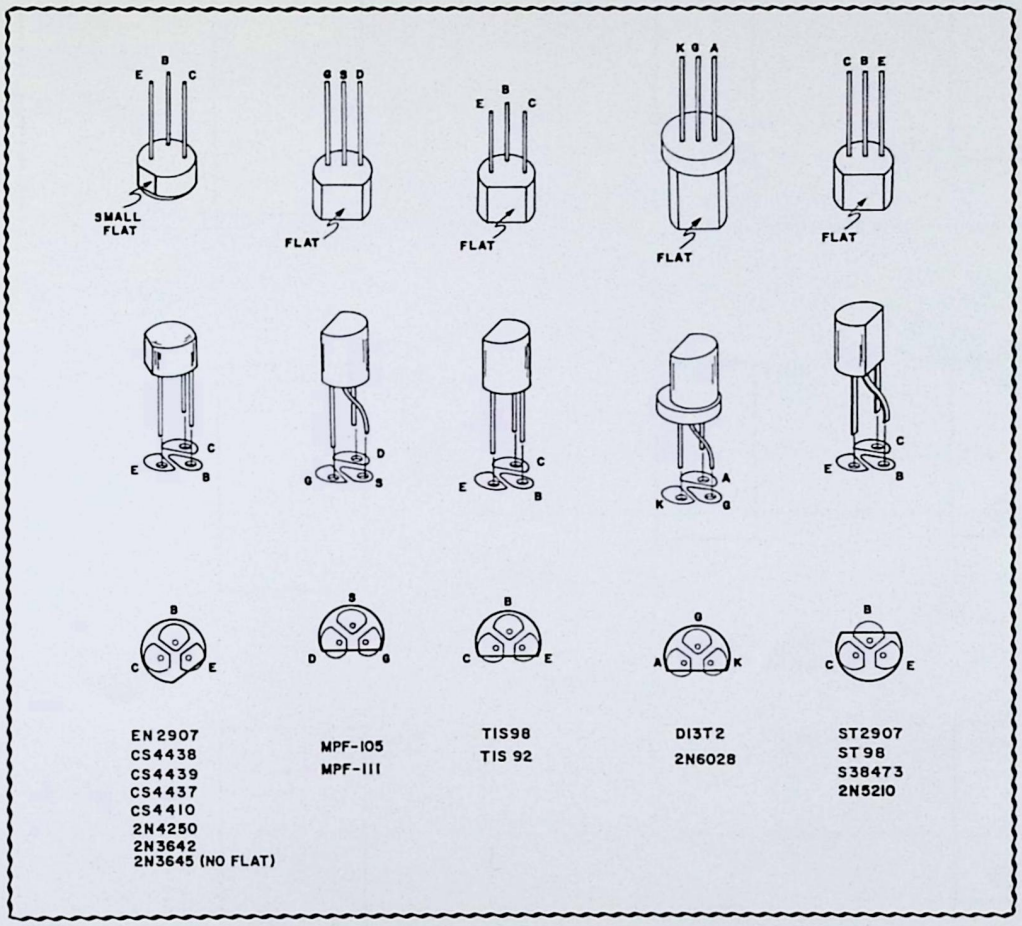


DISPLAY (LED)



INTEGRATED CIRCUITS (IC)

TRANSISTOR IDENTIFICATION CHART



In the above illustration the outline of each type of transistor is shown over the pads on the circuit board with the correct designation for each of the three leads. Use this information together with the information in the assembly manual for the correct orientation of the transistors as you install them.

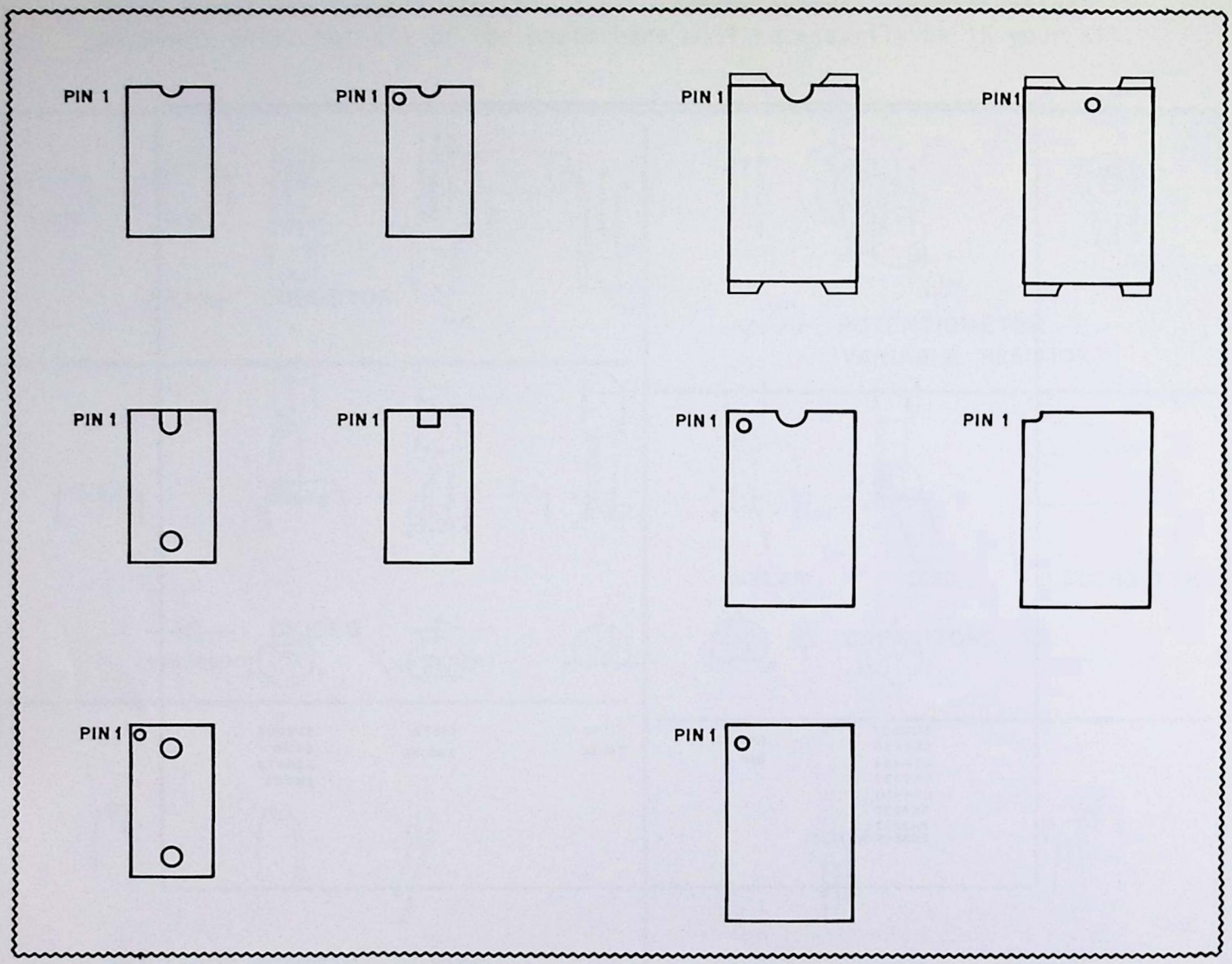
The following is a list of possible substitutions; if any others are used you will risk damaging your unit:

CS4410 = CS4437, CS4438, TIS98, ST98, S38473 (NPN)
EN2907 = ST2907, CS4439 (PNP)

For substitutions, refer to the information above to determine the correct orientation for the three leads.

APPENDIX C

IC ORIENTATION CHART



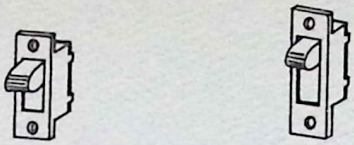
Integrated circuits (IC's) can come with any one of, or a combination of, several different markings. These markings are very important in determining the correct orientation for installation. Refer to the above drawing to determine the position of Pin 1 of the IC and use this information to orient it as described in the assembly manual.

WARNING!

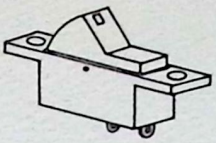
IF THE IC's ARE NOT PROPERLY ORIENTED DURING INSTALLATION,

IT MAY RESULT IN PERMANENT DAMAGE TO YOUR UNIT.

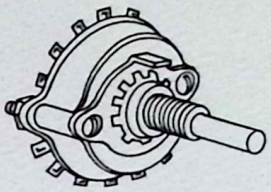
MISCELLANEOUS PARTS



SLIDE SWITCHES

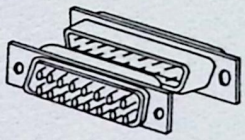


ROCKER SWITCH

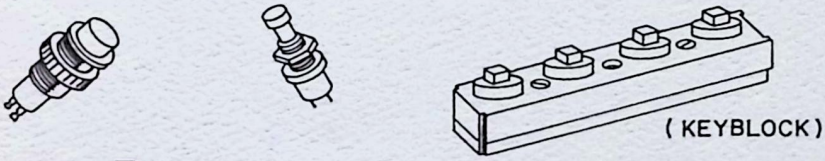


ROTARY SWITCH

JACKS



CONNECTOR

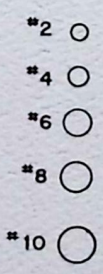


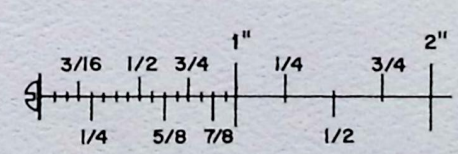
PUSH BUTTON SWITCHES

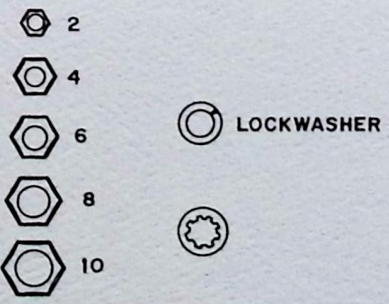
SOLDER OR GROUND LUGS

SCREWS · BOLTS · WASHERS

THE FOLLOWING GUIDE WILL AID YOU IN DETERMINING THE SIZES OF SCREWS, BOLTS, WASHERS IN YOUR KIT








ALTAIR
COMPUTER
SYSTEM
DOCUMENTATION
ALTAIR 8800 COMPUTER